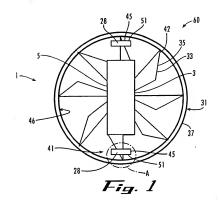
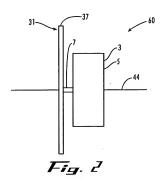
APPROVED: /JG/ /JG/ 02/12/2009

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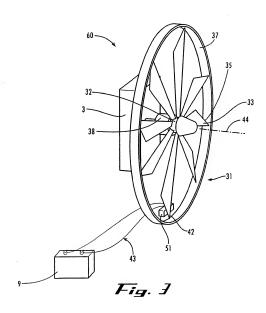
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APPROVED: /JG/

/JG/ 02/12/2009

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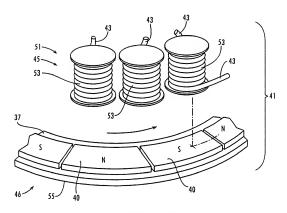


Fig. 4

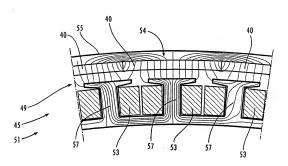
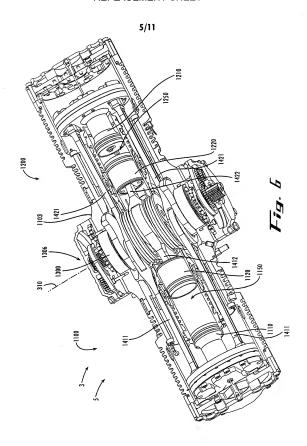
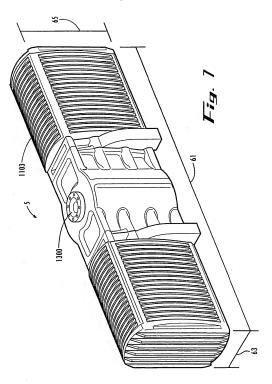


Fig. 5







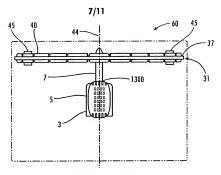
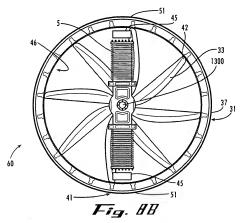
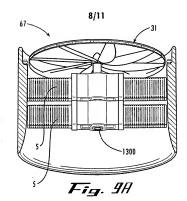
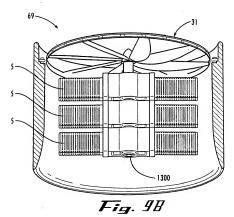


Fig. 8A







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Engine Design Input Data

Cylinder Bore	В	32	mm
Engine Stroke	S	60	mm
Conrod Length	L	50	mm
Engine Speed	N	9182	rpm
Compressian Ratia	CR	19	
Intake/Baast Pressure (abs)	Pi	0.9	bar
Intake/Baast Temperature	Ti	20	(
Fuel (D far diesel, G gasaline, M methanal)		d	
Stroke (FOUR for 4 strake, TWO 2 stroke)		twa	
Relative Air/Fuel ratio	Lambda	1.5	
Number of Cylinders	п	2	

Estimated Engine Performance Data

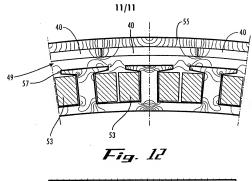
Estimated Engine Contoundance Date			
Cylinder Peak Pressure	Pmax	66	bar
Peak Pressure Phase (ATDC)	Alpha	5	deg
Break Mean Effective Pressure	BMEP	4.52	bar
Engine Power at the Given Speed	P	9.0	hp
Engine Tarque at the Given Speed	T	6.9	Nm

Fig. 1//

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FAI	AILY 1	a (two	cylin	der u	nit =	opo	c mo	dule, t	wo ge	ar-set)				
(yl.	Mach	Speed	MPS	Pistan Stroke		Pawer		opoc Weight		BSFC		Eff	Transmissian	
Nr.	Nr.	rpm	n/sec	cm	in	hp	kW	g lbs g/kWh ll		lbs/hp-hr	%	Planetary Transmission		
2	0.85	12500	11.0	2.64	1.04	9	6.7	1825	4.0	500	0.822	17%	Direct drive	
4	0.85	12500	11.0	2.64	1.04	17	12.7	3950	8.7	480	0.789	18%	Gear ratia: 1 =	0.66
6	0.85	12500	11.0	2.64	1.04	42	31.3	7743	17.1	430	0.707	20%	Gear ratia: 1 =	0.39
FAI	AILY 1	b (only	y one	stand	ardiz	ed o	ne cy	linder	unit :	= орос	module,	but th	ree gear-set)	
Cyl.	Mach	Speed	MPS	Pist Stro		Pov	ver	opoc Weight		BSFC		Eff	Transmission	
Nr.	Nr.	rpm	n/sec	cm	in	hp	kW	g	lbs	g/kWh	lbs/hp-hr	%		
2	0.68	10000	10.0	3.00	1.18	9	6.7	3150	6.9	450	0.740	19%	Direct drive	1.2
4	0.68	10000	10.0	3.00	1.18	17	12.7	6350	14.0	430	0.707	20%	Gear ratio: 1 =	2.08
6	0.748	11000	11.0	3.00	1.18	42	31.3	9550	21.1	400	0.658	21%	Gear ratio: 1 =	0.45
Ė								_			0.658 no 6 cyli		Gearratio: 1 =	0.45
FAI	AILY 2		cylind		its =		mod	_	one g	ear-set,		nder) Eff	Gearratio: 1 = Transmiss	
FAI Cyl.	AILY 2	(two	cylind	er uni Pist Stro	its =	opo	mod	ules,	one g	ear-set,	no 6 cyli	nder) Eff %	Transmiss	
FAI Cyl.	AILY 2 Mach Nr.	(two	cylind MPS	er uni Pist Stro	its = lan oke in	opo:	moc ver	opoc V g 1825	one g Veight	ear-set,	no 6 cyli SFC	nder) Eff		
FAI Cyl. Nr.	AILY 2 Mach Nr.	(two Speed rpm	MPS n/sec	Pist Stro cm 2.64 3.98	its = tan oke in 1.04	Pov hp 9	ver kW 6.7	opoc \ g 1825 5125	one go Weight Ibs 4.0	g/kWh 500	no 6 cyli SFC lbs/hp-hr	nder) Eff % 17% 21%	Transmiss Direct drive Direct drive	ion
FAI Cyl. Nr. 2	Mach Nr. 0.85	Speed rpm 12500 8300	MPS n/sec 11.0	er uni Pist Stro cm 2.64	its = tan oke in 1.04	Pov hp 9	ver kW 6.7	opoc V g 1825	one go Weight Ibs 4.0	ear-set, B g/kWh 500	no 6 cyli SFC Ibs/hp-hr 0.822	nder) Eff % 17% 21%	Transmiss Direct drive	
FAI Cyl. Nr. 2 2 4	Mach Nr. 0.85 0.85	(two Speed rpm 12500 8300	m/sec 11.0 11.0	Pist Strc cm 2.64 3.98 3.98	its = lan oke in 1.04 1.57	Pow hp 9 17	wer kW 6.7 12.7 31.3	opoc \ g 1825 5125 10600	Veight Ibs 4.0 11.3 23.4	g/kWh 500 400 380	no 6 cyli SFC bs/hp-hr 0.822 0.658	nder) Eff % 17% 21% 23%	Transmiss Direct drive Direct drive Gear ratio: 1 =	ion
FAI Cyl. Nr. 2 2 4	Mach Nr. 0.85 0.85 0.85	(two Speed rpm 12500 8300	MPS n/sec 11.0 11.0 11.0	Pist Strc cm 2.64 3.98 3.98	its = tan oke in 1.04 1.57 1.57 nits =	Pow hp 9 17	kW 6.7 12.7 31.3 oc m	opoc \ g 1825 5125 10600	Veight Ibs 4.0 11.3 23.4	g/kWh 500 400 380 lirect dr	no 6 cyli SFC lbs/hp-hr 0.822 0.658 0.625 ive and 2	Eff % 17% 21% 23% 2 cyline	Transmiss Direct drive Direct drive Gear ratio: 1 =	ion
FAI Cyl. Nr. 2 2 4	Mach Nr. 0.85 0.85 0.85	Speed rpm 12500 8300 8300 (three	MPS n/sec 11.0 11.0 11.0	Pist Strc cm 2.64 3.98 3.98 der u	its = tan oke in 1.04 1.57 1.57 nits =	Pov hp 9 17 42	wer kW 6.7 12.7 31.3	opoc \ g 1825 5125 10600	Weight lbs 4.0 11.3 23.4	ear-set, B g/kWh 500 400 380	no 6 cyli SFC bs/hp-hr 0.822 0.658 0.625	Eff % 17% 21% 23% 2 cylin-	Transmiss Direct drive Direct drive Gear ratio: 1 =	ion
FAI Cyl. Nr. 2 2 4 FAI Cyl.	Nr. 0.85 0.85 0.85 Mach	speed rpm 12500 8300 8300 (three speed	MPS n/sec 11.0 11.0 11.0 MPS MPS	Pist Cm 2.64 3.98 3.98 der u	its = in loke in l.04 l.57 l.57 nits =	Pov hp 9 17 42 op	kW 6.7 12.7 31.3 oc m	opoc \ g 1825 5125 10600 odules	Weight Ibs 4.0 11.3 23.4 Weight	g/kWh 500 400 380 lirect dr	no 6 cyli SFC lbs/hp-hr 0.822 0.658 0.625 ive and 2	Eff % 17% 21% 23% 2 cyline	Transmiss Direct drive Direct drive Gear ratio: 1 =	ion
FAI Cyl. Nr. 2 2 4 FAI Cyl. Nr.	Mach Nr. 0.85 0.85 0.85 Mach Nr.	Speed rpm 12500 8300 8300 (three	m/sec 11.0 11.0 11.0 MPS m/sec 11.0	Pist 2.64 3.98 3.98 der u	its = tan bke in 1.04 1.57 1.57 nits = ton bke in 1.04	Pov hp 9 17 42 op	kW 6.7 12.7 31.3 oc mer	opoc \ g 1825 5125 10600 odules	Weight Ibs 4.0 11.3 23.4 Weight Ibs	g/kWh 500 400 380 lirect dr B g/kWh	no 6 cyli SFC Ibs/hp-hr 0.822 0.658 0.625 ive and 2 SFC Ibs/hp-hr	Eff % 17% 21% 23% 2 cylin-	Transmiss Direct drive Direct drive Gear ratio: 1 = ders)	ion

Fig. 11



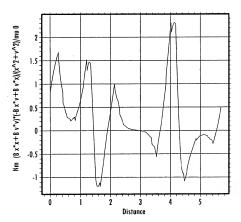


Fig. 13